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PROTEL TEC-20

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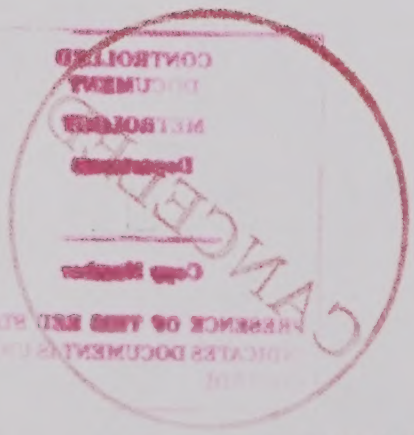
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Change Notice Summary

Revision	Reason For Change	Date Of Change

MAN-T20-001
MAY 1989

TEC-20

Terminal/Coin Equipment Tester, CO Simulator and Digit/Audio Monitor

CONTENTS PAGE

1. GENERAL ..... 1 - 1

2. TEST CAPABILITIES ..... 2 - 1

3. FEATURES AND SPECIFICATIONS ..... 3 - 1

4. FRONT PANEL DETAIL ..... 4 - 1

5. REAR PANEL DETAIL ..... 5 - 1

6. OPERATING INSTRUCTIONS ..... 6 - 1

7. COMPUTER EXTERNAL CONTROL ..... 7 - 1

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CONTENTS PAGE

1. GENERAL

1.01 ***Summary*** ..... 1 - 1

1.02 ***Inquiries*** ..... 1 - 1

1.03 ***Revision Summary*** ..... 1 - 1

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1. GENERAL

1.01 ***Summary:*** This practice provides specifications and operational instructions for the TEC-20 Terminal Equipment Tester.

1.02 ***Inquiries:*** All inquiries associated with the TEC-20 should be directed to:

PROTEL, INC.
4150 Kidron Road
Lakeland, FL 33811
(813) 644-5558

1.03 ***Revision Summary:***

4/15/85—Original release
Software—#TC0004
Aux. software—#TB002

1/15/86—Major edit
Software—#TC0006
Aux. software—#TB003
Add ground leak test
Add SIT tones

10/1/87—Major edit
Software—#TC0008 (computer control #TC0011)
Aux. software—#TB005 (computer control #TB009)
Add internal modem operation
Add computer external control

CONTENTS PAGE

2. TEST CAPABILITIES

2.01 *Coin, Charge-a-Call, and Credit Card Telephones* ..... 2 - 1

2.02 *Select-A-Carrier and Store-and-Forward Repertoire Dialers* ..... 2 - 1

2.03 *Monitor* ..... 2 - 1

---

2. TEST CAPABILITIES

2.01 ***Coin, Charge-a-Call and Credit Card Telephones:***

(a) Handset transmitter—acoustic response.

(b) Handset receiver—operation.

(c) DP dial—character, speed, % break.

(d) DTMF dial—character, freq., amplitude, twist, polarity guard.

(e) Credit card reader output.

(f) Ringer—freq. response.

(g) Hookswitch—sequence.

(h) Long and short loop tests.

(i) Can store 60 digits to download user software into phone.

(j) Coin relay collect/refund operate time and sensitivity.

(k) Coin telephone "A" relay operation test.

(l) Open loop coin test/coin totalizer operation.

(m) Response to various call progress tones including: ACTS, call processor answer, busy, ringback, second dial tones, etc.

(n) Answer supervision by simulating busy, ringback, etc.

(o) Handsets

- Transmitter—acoustic response.
- Receiver—operation.
- Cord—continuity.

2.02 ***Select-a-Carrier and Store-and-Forward Repertoire Dialers:***

(a) DTMF signaling-character, freqs., amplitude, twist.

(b) DP signaling-character, speed, % break.

(c) Cut-through transmission.

(d) Response to OCC answer tone simulation, programmable for 380, 400 or 350/440 Hz tone duration and number of occurrences.

(e) Response to Not-On-Network (NON).

(f) Response to incoming calls.

(g) Response to ACTS/ABC answer tone and credit card call processor answer tone.

(h) Can store up to 60 digits to download user software into phone.

2.03 ***Monitor*** (Central Office Loop Activity):

(a) Display up to 64 DTMF digits (32 at a time).

(b) Display freq., amplitude, twist of each digit.

(c) Display audio power level in dBm.

(d) Monitor speaker provides audio output.

CONTENTS PAGE

3. FEATURES AND SPECIFICATIONS

3.01 *General Features* ..... 3 - 1

3.02 *Central Office Loop Specifications* ..... 3 - 1

3.03 *Tone Generation* ..... 3 - 2

3.04 *Coin Control Functions* ..... 3 - 2

3.05 *Audio Power Meter* ..... 3 - 2

3.06 *DTMF Analyzer* ..... 3 - 3

3.07 *Dial Pulse Analyzer* ..... 3 - 3

3.08 *Digital Display* ..... 3 - 3

3.09 *Serial Interface* ..... 3 - 3

3.10 *Other Features* ..... 3 - 4

3.11 *Input Power* ..... 3 - 4

3.12 *Mechanical Specifications* ..... 3 - 4

3.13 *Options* ..... 3 - 4

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3. FEATURES AND SPECIFICATIONS

3.01 ***General Features:*** TEC-20 combines many pieces of test equipment into one unit that provides two principal modes of operation:

(a) ***Mode 1—Battery Feed:***

(1) Prepay coin repeater simulation

- "Must operate" and "must not operate" current test for collect and refund signals
- Display of operating time of coin relay in milliseconds.
- Totalizer operation test for coin ground indicating base rate is satisfied.
- Coin tone level measurement.
- Automatic collect, refund and stuck coin.
- "A" relay operation.

(2) Central office loop-start line simulator

- Simulates central office loop.
- Terminal equipment is powered and tested from TEC-20.
- Selectable line polarity and loop length.
- Selectable ringing frequencies.
- Selectable tones for precise dial tone and OCC answer tones.
- Selectable tone sequences for ringback, busy, DTMF generation, 1000 Hz, etc.

(b) ***Mode 2—Monitor:***

- Provides a high impedance bridge across tip and ring AC = 10K ohms, DC = infinity.
- Displays on command DTMF and signal power levels.
- Battery feed is not provided.

3.02 ***Central Office Loop Specifications:***

(a) ***Battery feed:*** 47 volts

(b) ***Loop:*** Selectable for short (440 ohms) or long (1380 ohms).

(c) ***Longitudinal balance:*** Exceeds FCC Part 68 requirements.

(d) ***Terminal impedance:*** 600 ohms ±1%.

(e) ***Loop polarity:*** Selectable for normal or reversed.

(f) ***Termination:*** USOC RJ11, RJ32.

(g) ***Ring generator:*** 16, 20, 30, 42, 54, 66-2/3 Hz.

3.03 ***Tone Generation:***

(a) ***Dial tone:*** precise, 350/440 Hz ±.5%.

(b) ***Busy:*** at 60 and 120 IPM 480/620 Hz ±.5%.

(c) ***Ringback:*** 440/480 Hz two seconds on, four seconds off.

(d) ***OCC answer tone:*** selectable 380, 400 or 350/440 Hz.

(e) ***OCC redirect tone:*** 400 Hz. gated 100 ms on, 100 ms off, 100 ms on.

(f) ***ACTS/ABC answer tone:*** 941/1477 Hz ±.5% for 100 ms followed by decaying dial tone.

(g) ***MF collect:*** 700/1100 Hz ±1% gated on 600 ms.

(h) ***MF refund:*** 1100/1700 Hz ±1% gated on 600 ms.

(i) ***MF ringback:*** 700/1700 Hz ±1% gated on 600 ms.

(j) ***$.05 deposit tone:*** 1700/2200 Hz ±1%.

(k) ***$.10 deposit tone sequence:*** 1700/2200 Hz ±1%.

(l) ***$.25 deposit tone sequence:*** 1700/2200 Hz ±1%.

(m) ***Modem answer tone:*** 2025 Hz ±1% gated on for 2 seconds.

(n) ***1000 Hz test tone***

(o) ***2600 Hz test tone***

(p) ***DTMF digit sequence:*** TEC-20 generates up to 60 DTMF digits including A, B, C, and D digits in each of two programmable fields. Digit duration is programmable from 35 ms to 200 ms. Interdigital time is programmable from 35 ms to 200 ms.

(q) ***MF digit sequence:*** TEC-20 generates up to 60 MF digits in each of two user programmable fields. Digit duration is programmable from 35 ms to 200 ms. Interdigital time is programmable from 35 ms to 200 ms.

(r) ***FSK 300 baud modem sender:*** TEC-20 generates up to 60 ASCII characters in each of two user programmable fields. Digits are sent at 300 baud rate on 1270 Hz carrier.

(s) ***SIT tones:*** Generated at an adjustable level with 30 ms off-time between frequencies.

(1) Reorder SIT: 913.8 Hz (274 ms), 1428.5 Hz (380 ms), 1776.7 Hz (380 ms).

(2) Vacant SIT: 985.2 Hz (380 ms), 1370.6 Hz (274 ms), 1776 Hz (380 ms).

(3) No connection SIT: 985.2 Hz (380 ms), 1428.5 Hz (380 ms), 1776 Hz (380 ms).

(4) Intercept SIT: 913.8 Hz (274 ms), 1370.6 Hz (274 ms), 1776 Hz (380 ms).

(5) Reorder interconnect SIT: 985.2 Hz (274 ms), 1370.6 Hz (380 ms), 1776 Hz (380 ms).

(6) No connection intercept SIT: 913.8 Hz (380 ms), 1370.6 Hz (380 ms), 1776 Hz (380 ms).

3.04 ***Coin Control Functions:*** Automatic and manual test to verify the following coin functions:

(a) ***Coin Relay Operate Current***

	Collect (ma)	Refund (ma)
Must operate high	+65/±6.3	-65/±6.3
Must operate low	+45/±3.6	-45/±3.6
Must not operate	+30/±1.8	-30/±1.8

Coin present— Ground current in excess of 3 ma during open loop coin test.

(b) ***Coin relay operating time:*** Displays time in milli seconds to clear coin during refund or collect.

3.05 ***Audio Power Meter:*** The power meter (multi-range, true RMS) provides bar graph indication of audio power level calibrated in dBm if terminated with an impedance of 600 ohms.

(a) ***Range A:*** -26 to +4 dBm ±1 dB in 2 dBm increments. Operates in either monitor or battery feed modes.

(b) ***Range B:*** -22 to -7 dBm ±.5 dB in 1 dBm increments. Active only in battery feed mode.

(c) ***Range C:*** -60 dBm to -10 dBm ±1 dB in 2 dBm increments. Used to set OCC tone levels.

Calibration impedance: 600 ohms ±1%.
Display: 16 segment bar graph

3.06 ***DTMF Analyzer:*** Capable of measuring and displaying actual DTMF digits as short as 40 milliseconds duration in either the monitor or battery feed modes. TEC-20 can display Actual (ACT.) vs Reference (REF.) frequency of the last digit dialed on command.

TEC-20 calculates actual frequencies during the first 40 ms of a tone burst. Frequencies are calculated to within ±1.0%.

3.07 ***Dial Pulse Analyzer:*** Provides a means to detect dialed digits and to display:

(a) ***Range, speed:*** 7 to 14 pps ±5%.

(b) ***Range, M/B ratio:*** 30 to 75% ±5%.

(c) ***Display:*** Records up to 64 digits.

(d) ***Display-on-command:*** Speed, % break.

3.08 ***Digital Display:*** Provides 32 digit LCD dot matrix with full ASCII capability. Storage is provided for 64 digits for displaying data, test set status and user prompt information. Displays the following:

(a) Loop supervision status on-hook/off-hook.

(b) Loop polarity normal/reverse.

(c) Ringing frequency.

(d) dBm output of DTMF generator.

(e) dBm output of transmitter.

(f) Each DP digit as dialed.

(g) Each DTMF digit as dialed including #, *, A, B, C, D.

(h) DTMF ACT. vs. REF. frequency of each digit dialed.

(i) Software identification.

(j) User prompt messages.

(k) Programming aids.

(l) Coin relay operating time in milliseconds.

(m) Ground leak test.

3.09 ***Serial Interface:***

(a) Provides a serial interface using RS-232 type signaling for an external printer.

- Signaling voltage -0 and +25.
- Printer software requirements:

1200 baud
8 data bits
2 stop bits
No parity
No ready nor busy leads
Automatic carriage return at end of line

(b) Provides simulation of central office functions by utilizing the internal modem operation of two connected TEC-20s.

(c) Provides computer external control using RS-232 type signaling for command functions. The TEC-20 accepts or transmits the following listed command functions:

TEC-20 Computer Functions

Input

Command to
- Activate/deactivate
- Test for on-hook/off-hook
- Read and signal back DTMF digit frequency
- Read a dial pulse digit on line under test
- Examine line under test for a coin present signal
- Generate coin collect/refund signals
- Supply normal/reverse/no loop current
- Supply specified tone

- Supply specified DTMF digits
- Send 300 baud output test stream
- Receive 300 baud output test stream

Output

Send

- Received DTMF digit frequency
- A specified "ring" signal onto line under test
- Results of a coin present signal test
- Coin collect/refund signals
- Normal/reverse/no loop current
- Specified tone
- Specified DTMF digits
- 300 baud output test stream
- Audio power readings from line under test

3.10 ***Other Features:***

(a) Audio monitor (with volume control)

(b) 1000 Hz acoustic test tone

3.11 Input Power:

(a) 177 VAC, 75 ma

(b) Three-wire cord

(c) Optional 240 VAC available

3.12 ***Mechanical Specifications:***

(a) Size: 8.5 in. (21.59 cm) width x 9.25 in. (23.5 cm) depth x 3.69 in. (9.3 cm) height

(b) Six position handle

(c) Weight: 5 lbs

(d) Operating temp: 0°C to 50°C

(e) Storage temp: -20°C to 60°C

(f) Relative humidity: 0 to 95%

3.13 ***Options:***

(a) CC003 fabric carrying case

(b) RS232 interface

TABLE 3.1

DTMF FREQUENCY LIMITS
(Suggested Limits for Standard Telephones)

	Low Frequency			High Frequency		
Digit	(-1.5%) Min.	Nom.	(+1.5%) Max.	(-1.5%) Min.	Nom.	(+1.5%) Max.
1	686	697	707	1190	1209	1227
2	686	697	707	1316	1336	1356
3	686	697	707	1454	1477	1499
4	758	770	782	1190	1209	1227
5	758	770	782	1316	1336	1356
6	758	770	782	1454	1477	1499
7	840	853	866	1190	1209	1227
8	840	853	866	1316	1336	1356
9	840	853	866	1454	1477	1499
*	926	941	955	1190	1209	1227
0	926	941	955	1316	1336	1356
#	926	941	955	1454	1477	1499

Note: Frequencies outside Table 3.1 may not be correctly displayed.

4. FRONT PANEL DETAIL

4.01 *LED's* ..... 4 - 1

4.02 *Test for Coin Ground (PB1)* ..... 4 - 1

4.03 *Monitor, RJ32 Jack J1* ..... 4 - 2

4.04 *Test Coin Telephone/Auto Dialer, Jack J2* ..... 4 - 2

4.05 *Test Telephone, RJ11, Jack J3* ..... 4 - 2

4.06 *Test Handset, Jack J4* ..... 4 - 2

4.07 *Volume Control* ..... 4 - 2

4.08 *Long Loop/Short Loop (SW2)* ..... 4 - 2

4.09 *Dial/Ring-dBm-Tone/dBm (SW3)* ..... 4 - 2

4.10 *Push Button (PB2)* ..... 4 - 2

4.11 *Speaker* ..... 4 - 2

4.12 *Display* ..... 4 - 2

4. FRONT PANEL DETAIL

4.01 *LED's*

(a) ***Green***—Collect signal has been sent to the coin telephone. Positive voltage on tip and ring; negative on ground.

(b) ***Red***—Refund signal has been sent to the coin telephone. Negative voltage on tip and ring; positive on ground.

(c) ***Amber***—"Coin present" illuminates when ground current is detected during coin check sequence; it is extinguished by collect or refund sequence. Also indicates ground current during "A" relay test.

4.02 ***Test for Coin Ground (PB1):*** Initiates an open loop coin check sequence as follows:

(a) ***Manual coin test (SW7 down):***

- Removes battery feed.
- Apply voltage to the tip with reference voltage to ground.

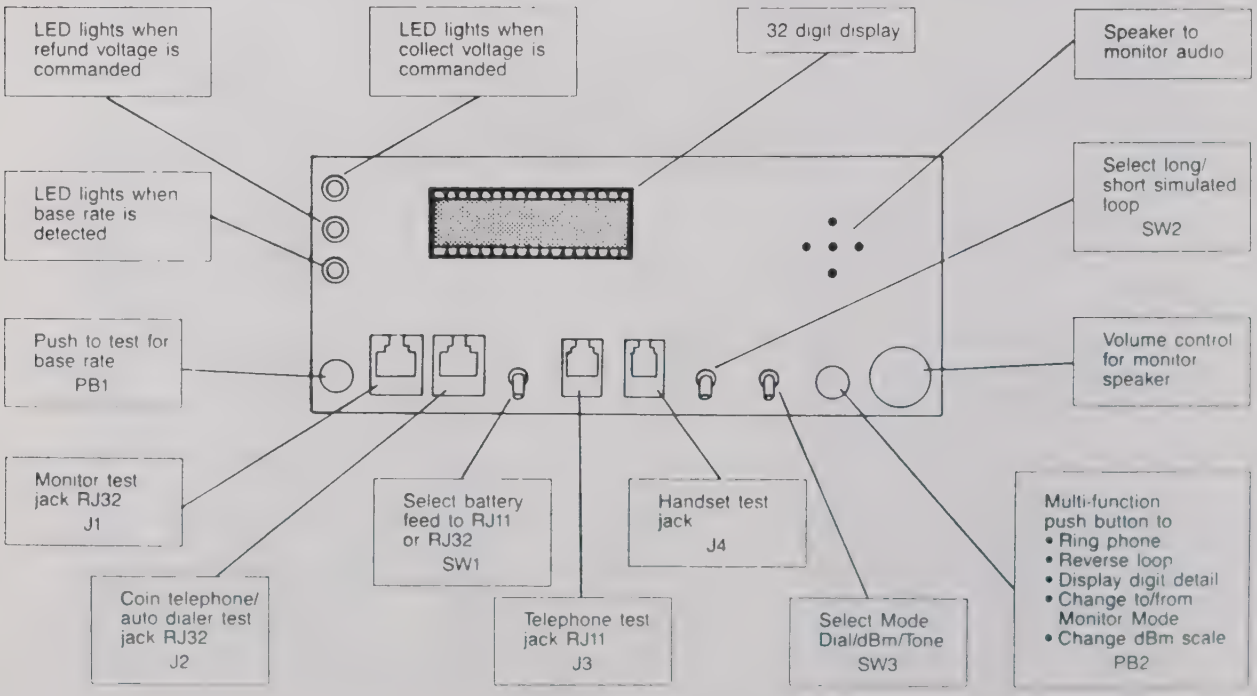
LED lights when refund voltage is commanded
LED lights when collect voltage is commanded
32 digit display
Speaker to monitor audio
LED lights when base rate is detected
Select long/ short simulated loop SW2
Push to test for base rate PB1
Volume control for monitor speaker
Monitor test jack RJ32 J1
Select battery feed to RJ11 or RJ32 SW1
Handset test jack J4
Multi-function push button to • Ring phone • Reverse loop • Display digit detail • Change to/from Monitor Mode • Change dBm scale PB2
Coin telephone/ auto dialer test jack RJ32 J2
Telephone test jack RJ11 J3
Select Mode Dial/dBm/Tone SW3

FIGURE 1

- Sense current in coin phone ground path greater than or equal to 3 ma and illuminate the "coin present led."

- Reapply battery feed

(b) ***Ground leak test (SW7 up):***

- Monitor for tip to ground leak current with C.O. battery applied to tip and ring. Amber led will flash with presence of ground.

- Exit ground leak test.

(c) ***SW7 in center position:***

- Provides programmable tone generation of up to 60 digits. Display 33rd to 65th digits when more than 32 digits have been dialed.

4.03 ***Monitor, RJ32 Jack J1:*** Provides a high impedance input to TEC-20 for connecting to Telco tip and ring in the monitor mode.

4.04 ***Test Coin Telephone/Auto Dialer, Jack J2:*** Modular input providing central office simulator loop tip to terminal 5, ring to terminal 4 when the SW1 (internal battery) switch is up. Terminals 8 and 1 connect to tip and ring of the telephone jack (3) respectively. Terminals 2 and 7 are connected together forming the ground path between the telephone instrument and TEC-20 circuitry for detecting coin ground.

4.05 ***Test Telephone, RJ11, Jack J3:*** When SW1 is in down position, provides tester central office simulator loop tip to terminal 4 and ring to terminal 3. Telephones or any other terminal equipment requiring RJ11 jacks can be tested when connected to this jack.

4.06 ***Test Handset, Jack J4:*** Provides DC loop excitation current to transmitter and 1000 Hz audio tone to receiver. For testing modular handsets and handset cords.

4.07 ***Volume Control:*** Controls monitor speaker amplitude except when 1000 Hz acoustic tone is being transmitted.

4.08 ***Long Loop/Short Loop (SW2):*** Selects central office loop simulation of 440 ohms DC when down, or 1380 ohms DC when up. AC impedance remains at 600 ohms regardless of switch position.

4.09 ***Dial/Ring-dBm-Tone/dBm (SW3):***

(a) ***Up position***: Test DP dial speed, % break, DTMF freqs. and ringers:

- Tester provides dial tone on tip and ring of RJ11 jack when telephone is placed off-hook.

- PB2 push button will ring on-hook, reverse off-hook polarity of off-hook phone, and provide digit detail of last digit dialed.

(b) ***Center position***: Test DTMF amplitude and twist. Test transmitter output.

- Quiet termination of central office loop simulator applied to jacks J2 and J3.

- Display shows signal power levels generated by the terminal equipment connected to J2 or J3 in battery feed mode.

- Enables TEC-20 to change between monitor and battery feed modes.

(c) ***Down position***: Test acoustic characteristics of transmitter.

- Display shows signal power levels on tip and ring generated by acoustic coupling of 1000 Hz signal from test set speaker to handset transmitter.

4.10 ***Push Button (PB2):*** Ring-on hook phone, reverse off-hook polarity.

- Change modes (monitor to battery feed).

- Change dBm scale, digit detail. (Preconditioned by position of SW3.)

- Reverse polarity (preconditioned by position of SW3).

- Activate ring generator.

- Exit OCC program.

4.11 ***Speaker:*** Provides audible monitor of activity on tip and ring of the unit under test.

4.12 ***Display:*** 2 digit dot matrix.

5. REAR PANEL DETAIL

5.01 *Level Adjust* ..... 5 - 1

5.02 *Power Switch (SW4)* ..... 5 - 1

5.03 *ATT Switch (SW5)* ..... 5 - 1

5.04 *Current Switch (SW6)* ..... 5 - 1

5.05 *Col/Auto/Ref (SW7)* ..... 5 - 1

5.06 *Push to Col/Ref (PB3)* ..... 5 - 1

5.07 *RS232 Din* ..... 5 - 1

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5. REAR PANEL DETAIL

5.01 *Level Adjust* control to set level of TEC-20 generated tones.

5.02 *Power Switch (SW4):*

5.03 *ATT Switch (SW5):* Attenuation of call progress tones: Up for 0 dB attenuation; center for 6 dB attenuation; down for calibrate. In calibrate mode, it places 600 ohms across tip and ring.

5.04 *Current Switch (SW6):* Up for 65 ma coin relay "must operate" current; center for 30 ma relay "must not operate" current; down for 45 ma relay "must operate" current.

5.05 *Col/Auto/Ref (SW7):* Up for refund, down for collect, center for auto.

5.06 *Push to Col/Ref (PB3):*

- SW7 up initiates collect.
- SW7 down initiates refund.
- SW7 center initiates programmable tone sequence.

5.07 *RS232 DIN* connector for outputting data to printer, memory devices, or controllers.

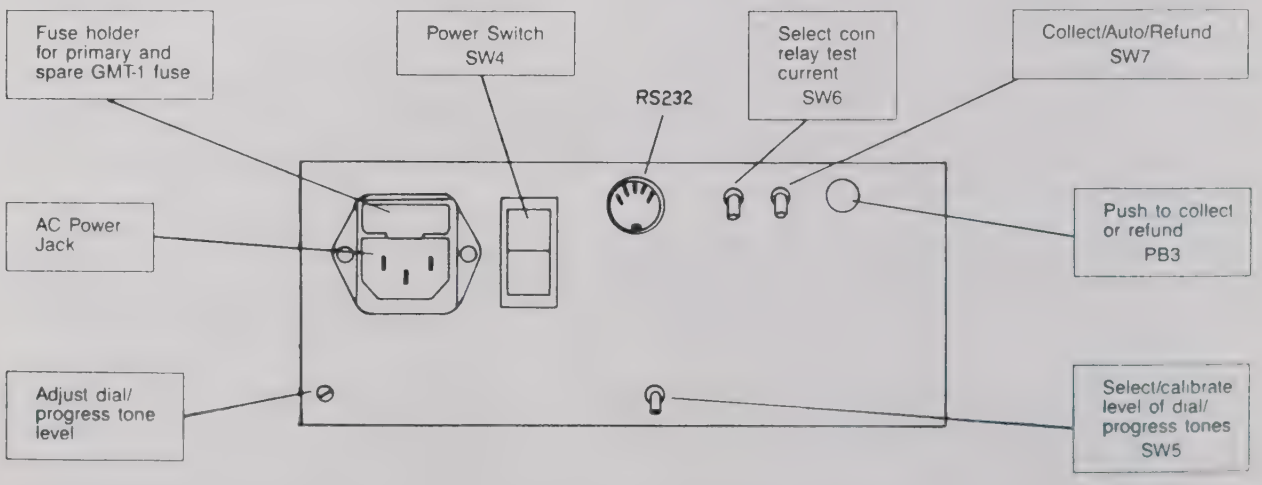
Fuse holder for primary and spare GMT-1 fuse
Power Switch SW4
RS232
Select coin relay test current SW6
Collect/Auto/Refund SW7
AC Power Jack
Push to collect or refund PB3
Adjust dial/ progress tone level
Select/calibrate level of dial/ progress tones SW5

FIGURE 2

6. OPERATING INSTRUCTIONS

6.01 ***Precautions*** ..... 6 - 1

6.02 ***Power-Up*** ..... 6 - 1

6.03 ***Program Tester for Alternate Ringing Frequency*** ..... 6 - 1

6.04 **Selecting Response Tones** ..... 6 - 2

6.05 ***Program PB1 and PB3 for Tone Sequences*** ..... 6 - 2

6.06 ***Program Tester for Alternate OCC Response Tones*** ..... 6 - 4

6.07 ***Test Charge-a-Call, Credit Card or Standard Telephone Instruments*** .... 6 - 5

6.08 ***Test Store-and-Forward Dialers*** ..... 6 - 6

6.09 ***Test Coin Telephone with Prepay Coin Repeater Simulator*** ..... 6 - 7

6.10 ***Monitor Mode*** ..... 6 - 8

6.11 ***Serial Interface*** ..... 6 - 8

6.12 ***Internal Modem Operation*** ..... 6 - 9

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6. OPERATING INSTRUCTIONS

6.01 ***Precautions:*** The TEC-20 is designed to provide trouble-free performance for many years. There are no switch combinations, test sequences or failure modes of FCC approved products that can cause damage. However, there are some situations that should be avoided to minimize chances of degradation or destruction to TEC-20 or shock hazard to the user.

DO NOT:
Attempt to test USOC wiring and jacks that have 110V 60 Hz power on them.

DO NOT:
Attempt to test Central Office facilities by connecting them to the incorrect input jack.

DO NOT:
Operate tester with cover removed. Potentially hazardous voltages exist within the unit.

DO NOT:
Leave SW5 (ATT SW) on rear panel in CAL position.

CAUTION—Tip/ring leads could create electrical shock during ringing, collect or refund cycles.

6.02 ***Power-Up:***

(a) Connect tester to 110V AC outlet with neutral ground

(b) Turn power on/off rocker switch (SW4) located on rear panel beside power cord to"on" position. (Refer to Figure 1B for location.)

(c) During the power-up sequence, the tester displays **TEC-20** for two seconds followed by the software number, copyright and assistance information. If no information appears on display, check fuse located on rear of tester. (See figure 1B for location of switch and fuse. A spare fuse is stored in the fuse holder. Fuse type GMT-1, 1 amp cartridge.)

(d) TEC-20 powers up as follows:

- Ringing generator freq. set to 20 Hz
- Batt. feed mode
- Normal loop polarity
- OCC response disabled
- Last programmed tone sequence (PB1 and PB3)

(e) To reinitiate power-up sequence, power switch must remain off for 5 seconds before returning power on.

6.03 ***Program Tester for Alternate Ringing Frequency:*** The ringing freq. defaults to 20 Hz when the tester is initially powered up. The freq. can be changed by placing the phone off-hook and dialing:

71 for 16 1/3 Hz
72 for 20 Hz
73 for 30 Hz
74 for 42 Hz
75 for 54 Hz
76 for 66 2/3 Hz
79 selects ring scan sequence

The last selected ringing freq. remains in the tester memory until power is removed or a different digit combination 7X is dialed immediately after off-hook. The tester displays the time period since release of the ring-in button for up to 16.5 seconds. This feature can be used to measure time out of key system interrupters and to aid the user in simulating multiple ring bursts from the central office. If the telephone instrument is placed off-hook during the 16.5 second period after ring-in, TEC-20 will provide a quiet termination to simulate actual central office operation.

Ring scan: If the ringing frequency of the unit under test (UUT) is unknown, place UUT off-hook, dial 7 9 and go on-hook. Depress and hold PB2 (ring on-hook) push button. TEC-20 will generate a two-second burst of ring signals at 20 Hz, followed by successive two-second ring signals at 30, 42, 54, 66-2/3 and 16-1/3 Hz. The sequence repeats as long as PB2 is depressed. The display indicates the ringing frequency at all times.

6.04 ***Selecting Response Tones:*** TEC-20 can generate an assortment of tones as a result of dialing a seven-digit code combination. When testing prepay coin telephones, the majority of the dial-up tone simulation numbers require SW7 col/auto/ref to be in the auto position along with the deposit of the base rate. A coin check is made immediately after dialing the seven-digit code. If SW7 is in either the "col" or "ref" position, coin check is not automatically made.

Operation of the dial-up tone sequence is as follows:

(a) Follow power-up procedure as outlined in paragraph 7.02.

(b) Verify that TEC-20 is in battery feed mode.

(c) Connect charge-a-call, credit card or standard telephone instrument to jack J3 and place SW1 to down position or connect coin telephone or dialer to jack J2 with SW1 in the up position.

(d) The levels of all simulated tones are adjustable between -60 dBm to -15 dBm via rear panel level adjustment pot R1.

The TEC-20 will generate any of the following responses two seconds after the last digit of the specified code combination:

Access Code	Tone Sequence
221-XXXX	Slow busy (60 IPM)
222-XXXX	Fast busy (120 IPM)
223-XXXX	Ring-back steady (440/480 Hz)
224-XXXX	Ring-back followed by 380 Hz
225-XXXX	Ring-back followed by 400 Hz
226-XXXX	1000 steady Hz
227-XXXX	DTMF scale 0, 9, 8, 7, 6, 5, 4, 3, 2, 1, *, #, A, B, C, and D. 60 ms on/60 ms off
228-XXXX	MF collect (700/1100 Hz)
229-XXXX	MF refund (1100/1700 Hz)
220-XXXX	MF ring-back (700/1700 Hz)
230-XXXX	Modem answer tone (2025 Hz)
231-XXXX	Reorder SIT
232-XXXX	Vacant SIT
233-XXXX	No connection SIT
234-XXXX	Intercept SIT
235-XXXX	Reorder SIT interconnect
236-XXXX	No connect SIT interconnect
0-8XX-XXXX	ACTS/ABC tone, # followed by decaying dial tone
0-8XX-XXX-XXXX	ACTS/ABC tone, # followed by decaying dial tone

6.05 ***Program PB1 and PB3 for Tone Sequences:*** Push buttons PB1 (test for coin ground) located on the front panel and PB3 (col/ref) located on the rear panel can be programmed to generate a custom sequence of up to 60 tones each.

Tone programming PB1 and PB3:

(a) Follow power-up procedure as outlined in paragraph 7.02.

(b) Verify that the TEC-20 is in the battery feed mode.

(c) Connect DTMF telephone instrument to jack J3 and place SW1 to down position or connect a coin telephone to jack J2 and place SW1 to up position. Place SW7 in to the auto position (center).

(d) PB1—Go off-hook, dial 2*XX where XX represents a two-digit code from Table X or Y. Go on-hook. If the code was from Table Y, go to paragraph 7.06f for digit timing programming.

(e) PB3—Go off-hook, dial 2#XX where XX represents a two-digit code from Table X or Y. Go on-hook. If the code was from Table Y, go to paragraph

7.05g for digit timing programming.

(f) Programming DTMF or MF digit on-time and interdigital time for the front panel switch PB1 is as follows:

- Dial 2*0* XY and go on-hook. Where X defines the on-time and Y the interdigital time. See Table Z for values.

(g) Programming DTMF or MF digit on time and interdigital time for the rear panel switch PB3 is as follows:

- Dial 2#0* XY and go on-hook. Where X gives the on-time and Y the interdigital time. See Table Z for values.

TABLE X
CODED TONE SEQUENCE
TRANSLATION TABLE

Code	Tone Sequence
01	Slow busy (480/620 Hz) 60 IPM
02	Fast busy (490/620 Hz) 120 IPM
03	Ring-back steady (440/480 Hz) 2 sec on/4 sec off
04	Ring-back (440/480 Hz) + 380 Hz. Two bursts of ring-back followed by 380 Hz for two seconds
05	Ring-back (440/480 Hz). Two bursts of ring-back followed by 400 Hz for two seconds
06	1000 Hz steady
07	MF collect (700/1100 Hz)
08	MF refund (1100/1700 Hz)
09	MF ring-back (700/1700 Hz)
10	ACTS/ABC tone
11	Dial tone
12	Modem answer
13	Nickel sequence 1700/2200 1 burst
14	Dime sequence 1700/2200 2 bursts
15	Quarter sequence 1700/2200 5 bursts
16	2600 Hz tone
17	380 Hz answer tone for two seconds
18	600 Hz answer tone for two seconds
19	Redirect tone (400 Hz on and off for 100 ms)
23	Reorder SIT
24	Vacant SIT
25	No connect SIT
26	Intercept SIT
27	Reorder SIT interconnect
28	No connect SIT interconnect

TABLE Y
CODED TONE SEQUENCE
TRANSLATION TABLE

Code	Tone Sequence
20	And enter 1 to 60 digits maximum. Go on-hook after last digit. These digits will be sent in DTMF format when button is pressed. See paragraph 4.05f or g for on-time and interdigital time programming.
21	And enter 1 to 60 digits maximum. Go on-hook after last digit. These digits will be sent in a multifrequency (MF) format when button is pressed. Wherever a "*" digit is detected in this 60 digit field, an MF (KP digit) will be sent. Any "#" digit programmed into the 60 digit field will be sent as an MF (ST) digit. See paragraph 4.05f or g for the on-time and interdigital time programming of the MF (KP) pulse. The KP digit will gate on for 100 ms regardless of the digit on-time selected in paragraph 4.05g or h.
22	And enter 1 to 60 digits maximum. These 60 digits will be sent in FSK format at a 300 baud rate. A 1270 Hz carrier tone is maintained on the line. This is used for modem originate.
29	And enter 1 to 60 digits maximum. These 60 digits will be sent in FSK format at a 300 baud rate. A 2225 Hz carrier tone is maintained on the line. This is used for modem answer.

TABLE Z

Digit Value For X & Y	Time in Milliseconds	Digit Value For X & Y	Time in Milliseconds
1	35	7	65
2	40	8	70
3	45	9	75
4	50	0	80
5	55	*	100
6	60	#	200

(h) Set amplitude of tones by adjusting level adj. control on rear panel.

(i) Tone sequence operation via PB1 or PB3.

- Follow power-up procedure as outlined in 7.02.
- Program PB1 or PB3.
- Place SW7 col/auto/ref switch to center (auto) position (See CAUTION).
- Verify that the TEC-20 is in the battery feed mode.
- Connect equipment to either J2 or J3.
- Press PB1 (test for coin ground) any time unit under test is off-hook to generate sequence programmed in paragraph 7.05d or press PB3 (push to col/ref) to generate the tone sequence programmed in paragraph 7.05e.

CAUTION—When SW7 (col/auto/ref) is in the auto position, a ±130V pulse will automatically be generated on J2 and J3 upon hang-up. If this ±130V pulse is undesirable, place SW7 in either the col or ref position prior to hang-up.

Example: Programs

(1) Program PB1 to generate the following DTMF digit sequence (9, 5, 4, 3, 2, 1, *, 6, 7, 8, 9, 0) with a digit on time of 40 ms with an interdigital time of 80 ms.

With TEC-20 in battery feed mode and DTMF instrument off-hook, dial the following sequence:

2 * 2 0 (9, 5, 4, 3, 2, 1, *, 6, 7, 8, 9, 0) on-hook

2 * 0 * 2 0 on-hook (Program is complete)

(2) Program PB3 to generate the following MF digit sequence (KP, 9, 8, 7, 6, 5, 4, 3, 2, 1, ST) with a digit on time of 50 ms and an interdigital time of 40 ms.

With TEC-20 in battery feed mode and DTMF instrument off-hook, dial the following sequence:

2 # 21 *, 9, 8, 7, 6, 5, 4, 3, 2, 1, # on-hook

2 # 0 * 4 2 on-hook (Program is complete)

6.06 ***Program Tester for Alternate OCC Response Tones:*** Prior to testing the OCC dialer, TEC-20 can be programmed to generate appropriate answer and progress tones to simulate various OCC switches during the progression of the call.

Programming TEC-20 for alternate OCC responses consists of selecting the appropriate progress tone (400 Hz, 380 Hz or precise 350/440 Hz), the number of times the tone will be generated and the duration of the tone.

- When single tone time-out is selected, the selected OCC tone will only be generated one time per call and only after a 3-second pause following the last digit dialed. Also, at least 7 digits minimum must be dialed before tone time-out is enabled. The tone is continuous until receipt of the next digit or the expiration of the programmed time-out duration.
- When multiple tone time-out is selected, dial tone will be given after off-hook and after the first digit to simulate Centrex operation. However, after the second digit, the selected OCC tone will be generated after every 3-second pause in dialing.
- When programmed for redirect and after the UUT sends the access number, TEC-20 will generate the programmed OCC answer tone. The duration of the tone will be determined by the value of the Z digit and the frequency by the value of the W digit programmed. If additional digits are sent during or after the generation of the OCC answer tone, TEC-20 will generate a 400 Hz redirect signal for 100 ms followed by a 100 ms off period, followed by another 100 ms burst. The tone burst level will be determined by the setting of the tone level adjustment R1 on rear panel (-40 dBm to -15 dBm). If the UUT redirects the call, TEC-20 will clear the display and present precise dial tone. TEC-20 will display the redirected number after the dialer completes the redirect sequence.

Programming tone simulation is accomplished as follows:

- Connect touchtone telephone to test telephone jack (J3) with instrument on-hook.
- Place SW1 (internal battery) to down position.

- On rear panel place SW5 (att switch) down to calibrate position. (A tone may be heard.)

- Place telephone instrument off-hook and dial:

  * * 9WYZ (if OCC redirect signal is not required.

  * * 8WYZ (if OCC redirect signal is required)
  Where * = DTMF * digit

8	= 8 digit	Z	= 2 for 2.0 sec tone
9	= 9 digit	Z	= 3 for 3.0 sec tone
W	= 1 for 400 Hz	Z	= 4 for 4.0 sec tone
W	= 2 for 380 Hz	Z	= 5 for 5.0 sec tone
W	= 3 for 350/400 Hz	Z	= 6 for 6.0 sec tone
Y	= 1 for single tone	Z	= 7 for 7.0 sec tone
Y	= 2 for multiple tones	Z	= 8 for 8.0 sec tone
Z	= 0 for 0.5 sec tone	Z	= 9 for 9.0 sec tone
Z	= 1 for 1.0 sec tone	Z	= # or * for continuous tone

After the Z digit is entered in a **9 WYZ or **8 WYZ sequence, TEC-20 will display the following:

(a) Selected frequencies

(b) Selection of single or multiple tone timeouts

(c) Tone duration

- Three seconds after displaying the set-up format, the TEC-20 will display a bar graph scale and gate on the calibration oscillator.

- Go on-hook.

- Adjust the tone level control, located on the rear panel, to desired dBm level. (First asterisk showing on the display equals -40 dBm, each additional asterisk indicates increase of 2 dBm.)

- Return SW5 (dB att switch) to up position for 0 dB attenuation.

- Momentarily depress PB2 (digit detail) push button to exit from programming mode.

This completes programming for OCC switch simulation. The tone time-outs can be cancelled at any time by going off-hook and dialing ##9.

Note 1: UUT may ring when depressing PB2.

Note 2: The tone level adjustment is typically set to 3dB above the minimum sensitivity of the Unit Under Test (UUT). Therefore, when the att. switch on the rear panel is moved to the center 6 dB position, the UUT should not recognize OCC answer tone or redirect tone.

6.07 ***Test Charge-a-Call, Credit Card or Standard Telephone Instruments:*** Follow power-up procedure as outlined in 7.02, verify that TEC-20 is in the battery feed mode, and connect telephone instrument or unit under test (UUT), to jack J3 and place SW1 to down position.

(a) ***Digit display and analysis:***

- Unit under test is on-hook.

- Place SW3 (dial/tone) switch to up position.

- Select loop length with SW2 (long loop/short loop) switch.

- Place UUT off-hook and observe precise dial tone from the telephone receiver and the speaker. The speaker amplitude is controllable with the volume control. The display is blank at this time. TEC-20 provides battery feed to the unit under test with tip positive and ring negative. If PB2 (digit detail) is pressed before the first digit is dialed, loop polarity will reverse and dial tone will be terminated. Pressing PB2 the second time before dialing the first digit will return tip positive and ring negative. TEC-20 maintains the programmed polarity for the duration of the call. Each new call attempt begins with the loop polarity normal and dial tone ON.

- Dial a digit and notice that it appears in the display's first digit position. The next 31 successive dialed digits will appear in sequence. After the first 32 digits, digits 33 to 64 will not appear on the display, but instead will be recorded in memory. The display will hold and display the first 32 digits during this period. To view the 33rd thru 64th digits, press PB1 (test for coin ground) switch after dialing stops. The first 32rd digits will be erased and the 33rd through 64th digits will be displayed.

- Digit detail of DTMF characters—The frequencies of the last digit dialed can be displayed by depressing PB2 (digit detail) push button. The reference frequencies appear on line 1; the actual frequencies appear on line 2 and should be between the low and high limits in accordance with industry standards.

- Digit detail of dial pulse (D.P.) characters—The speed in pulses per second.

- P.P.S. and the percent break of the last digit dialed can be displayed by depressing PB2 (digit detail) push button after dialing any digit, except 1 or 2. The first line of the display indicates speed in P.P.S. and the second line of the display shows the M/B ratio in percent break.

- The succeeding dialed digit will appear on the display's first digit position.

- To erase the display showing dialed digits, momentarily depress PB2. This will display digit detail of the last digit dialed. The next dialed digit will erase the display and that digit will appear in the upper left corner.

(b) ***Measure Signal Power:***

- Follow power up procedures outlined in paragraph 7.02.

- Unit under test must be on-hook.

- Verify that TEC-20 is in the battery feed mode.

- Place SW3 (dial/tone) switch to center position. Observe that the top line of the digital display indicates dBm scale. Either -22 to -7 dBm scale in one dB increments, or -26 to +4 dBm scale in two dB increments can be selected. The scale can be changed by briefly depressing push button PB2.

  Note: If switch PB2 is depressed for 2 seconds or longer, TEC-20 will enter the monitor mode.

- If the unit under test is a telephone instrument, speaking into the transmitter causes the bottom half of the display to modulate as a bar graph indicative of signal power on tip and ring.

- Loop length (long loop/short loop) can be selected with SW2 (long loop/short loop) switch.

(c) ***Twist Measurement of Telephone Instrument:*** With SW3 (dial/tone) switch in the dBm (center) position, depress and hold any digit button of the tone pad and notice the bar graph deflection to be between -6 and +2 dBm. Depress two row buttons. (Example; digits 1 and 4) and observe single tone power of -10 to 0 dBm (high group). Depress two column buttons (Example; digits 1 and 2) and observe single tone power output of -12 to -2 dBm (low group). Maximum twist, high group to low group should not exceed 4 dB. Repeat for both long and short loop settings of SW2 (long loop/short loop).

Note: This twist test may not work on certain types of DTMF dials. Newer dials which produce timed signals or which block signals if two buttons are depressed cannot be measured.

(d) ***Acoustic Test:*** Move SW3 (dial/tone) switch to the down position and observe 1000 Hz tone coming from the test set speaker. Place the handset transmitter over the speaker and view the bar graph indication, at approximately -16 dBm to -4 dBm.

(e) ***Test Individual Handset:*** Place SW3 (dial/tone) switch to the down position. Connect handset to test handset jack (J4). Listen for 1000 Hz audio tone in receiver. Place transmitter over speaker and observe bar graph display of transmitter pick-up.

(f) ***Ring-in Test:***

- Place unit under test on-hook.

- SW3 (dial/tone) switch in up position; TEC-20 displays: ON-HOOK!!! IDLE BATT. FEED MODE.

- Depress PB2 (ring on-hook) push button. Display shows RING STATION WITH 20 HERTZ. TEC-20 applies a two-second burst of ring signal at the prescribed ring frequency each time PB2 is depressed.

- Ring time-out timer is displayed.

6.08 ***Test Store-and-Forward Dialers:*** Follow power-up procedure as outlined in 7.02, verify that TEC-20 is in the battery feed mode, and verify that all equipment connected to TEC-20 is on-hook.

(d) *Dialer Test:*

- Connect dialer under test to test coin telephone/ auto dialer jack J2 and telephone instrument to J3.

- SW1 (internal battery) to up position and telephone on-hook.

- With SW3 (dial/tone) switch in the up position, TEC-20 provides the battery feed loop to the dialer, TEC-20 records and displays all of the digits as they appear on the battery feed loop (identical to actual dialer operation). TEC-20 generates the OCC answer and progress tones according to tone selection and ATT switch setting on the rear panel. TEC-20 also records the dialer response to these tones. Digit detail analysis of the last DP or DTMF digits from the dialer can be displayed on command following the same procedure as outlined in paragraph 7.07.

  DTMF signal power from the dialer is measured as outlined in paragraph 7.07.

6.09 ***Test Coin Telephone with Prepay Coin Repeater Simulation:*** Using cable CA003, connect the coin telephone to jack J2 with Tip – green – J2 pin 5; ring – red – pin 4; and ground – black – pins 2 or 7.

All the standard dial, ring and transmission tests can be performed on the telephone while connected to jack J2.

TEC-20 has both a manual and an automatic method for doing coin tests. Results of the coin tests will be indicated on the digit display or the front panel "collect/refund" and "coin present LED's."

(a) *Manual Coin Escrow Relay Tests*

- Verify that TEC-20 is in the batt.feed mode.

  SW7 (col/auto/ref) switch must be up for collect or down for refund.

  During manual operation, all coin control functions are performed with switches and buttons located on the rear and front panels.

(1) Coin relay collect/refund—PB3 (push to col/ref) activates the collect or refund sequence. SW7 (col/auto/ref) determines the polarity; up for collect, down for refund. SW6 determines the coin relay activation current and is internally preset as follows:

Up = "must operate" (65 ma)
Center = "must not operate" (30 ma)
Down = "must operate" (45 ma)

Collect and refund commands can be executed with or without base rate being satisfied. The appropriate collect or refund LED indicates the current driving the coin relay until the coin relay action begins. The collect/refund LED's do not indicate if a coin relay is wired incorrectly or when no coin is present.

To display the operating time of the collect/refund relay, perform the following: with the phone on-hook, place SW7 (col/auto/ref) in the desired position and press PB3 (push to col/ref), the operate time is displayed on the TEC-20.

The digital display indicates the operate time for the coin relay after every collect or refund cycle. The display will activate within 750 ms. The display will indicate "coin not present" if no coin is detected.

(2) "A" relay test—To test the operation of the "A" relay, place SW2 (select long/short loop) in the down position (short loop) and place SW7 (collect/auto/refund) in the up position (collect). With the coin phone off-hook, deposit the base rate and momentarily press PB1 (test for coin ground). TEC-20 will display "ground leak test." If the "A" relay contacts do not open with loop current present, the amber LED will flash indicating a current path to ground. The amber LED will stop flashing when the ground leak is removed. If the "A" relay contacts do open with loop current, TEC-20 will display "ground leak test OK" and no LED will flash. Press PB1 (test for coin ground) to exit test.

(3) Manual totalizer base rate check (Western 1C coin phone)—SW7 (col/auto/ref) switch must be in the (down) ref. position.

Deposit one nickel, then momentarily press PB1 (test for coin ground) push button. Deposit additional nickels pressing the PB1 button between each coin deposit. When the total deposit equals or exceeds the base rate setting of the coin totalizer in

the phone, the totalizer homes and the telephone emits the coin deposit beep tones. When base rate is satisfied, the coin present LED illuminates when PB1 button is pressed. Coin present LED is extinguished when a collect or refund is made.

Press and hold a tone pad dial button or hold the rotary dial off-normal. Deposit a coin and notice that coin tones are not heard. Release the dial. Deposit a coin and notice that coin tones are heard.

Go on-hook. Come off-hook and press PB2 for 1 second. Tip/ring polarity is now reversed simulating +48V battery from TSPS operator. Repeat the coin deposit test in the previous paragraph. Coin tones are not muted but the dial is disabled.

(b) ***Automatic Coin Trunk Simulation:***

- Verify TEC-20 is in "batt. feed" mode.
- SW7 "col/auto/res" switch must be in the center "auto" position. Set SW6 switch to select the desired refund and collect current.

(1) Test for deposit of less than base rate—Coin telephone off-hook; dial "223-1111". TEC-20 performs an open loop coin check after the 7th dialed digit. If no coin is deposited or if the coins deposited are less than the base rate set on the totalizer in the telephone, TEC-20 will generate a fast busy and upon going on-hook, automatically generates a refund command and go to idle.

(2) Test for deposit of base rate or greater—Coin telephone off-hook; deposit base rate and dial "223-1111". TEC-20 performs an open loop check after the 7th dialed digit. If the telephone shows a base rate ground signal, TEC-20 display indicates ring-back steady. On hang-up, TEC-20 generates a collect signal. The coin present LED goes off and the collect LED lights. If the coin is stuck, the display indicates stuck coin.

Note: PB1 and PB3 have no control over coin functions when SW7 is in the auto position.

6.10 ***Monitor Mode:*** Follow power-up procedure as outlined in paragraph 7.02. TEC-20 will power-up in the "batt.feed" mode.

(a) ***Select "monitor" mode:***

- Remove all plugs from jacks J2, J3 and J4.
- Place SW3 "dial/tone" switch to the center position.
- Press PB2 "digit detail" push button for two seconds until "monitor" appears on the display.

(b) ***Digit display and analysis (DTMF only):***

- Plug CA001 cable assembly (with RJ32 and alligator clips) into J1 "monitor" test jack. Connect alligator clips to tip and ring of line to be monitored.
- Place SW3 (dial/tone) switch to the up position. TEC-20 responds by displaying the word "monitor" in bottom right-hand corner of display.
- DTMF digits are displayed as received.
- The audio signals on the telephone line can be monitored on the TEC-20 speaker. Adjust TEC-20 volume control to desired level.

(e) ***Digit detail of DTMF characters:*** The frequencies of the last digit dialed can be displayed by pressing PB2 (digit detail) push button. Both the reference and actual frequencies are displayed. Dialing a succeeding digit after a digit detail readout causes the display to erase. This succeeding digit appears in the display's first digit position.

(f) ***Measuring signal power in "monitor" mode:***

- Verify that TEC-20 is in "monitor" mode.
- Set SW3 (dial/tone) switch to the center position.
- Conversation or dialing on the telephone line will cause the lower half of the display to modulate as a bar graph indicative of signal power on tip and ring.

6.11 ***Serial Interface:*** TEC-20 provides a serial interface output that can drive an external printer. The RS-232 type signaling is provided on DIN jack (J5) mounted on the rear of the TEC-20.

(a) ***Printer Jack Identifications*** (DIN 5 pin jack):

(1) Pin numbering—

G - Ground voltage reference – Pin #2
I – Input data – Pin #1
O - Output data –Pin #3

(2) Pin Locations—Looking at the back of the TEC-20 DIN jack (J5)

(b) ***Operation of TEC-20 RS232:***

(1) Power-up sequence—

- Carriage return
- Three line feeds
- Protel TEC-20 ready (message)
- Carriage return
- Three line feeds

(2) The following test information is provided on the serial interface:

- All digits as they are dialed (battery feed mode)
- Results of coin check
- Collect or refund information—operate time of coin relay, stuck coin information, etc.
- Hang up

6.12 ***Internal Modem Operation:***

(a) ***TEC-20 switch settings:***

- SW1 – up for coin phone, down for standard phone
- SW2 – up (long loop)
- SW3 – up (dial/ring position)
- SW5 – up (0 dB)
- SW6 – up (65 ma)
- SW7 – up for standard phone, center for coin phone
- Program unit dial: 2 * 0 # 1 Z
  Where Z = unit code (0-9)

Note: If you are not using TEC-20 for internal modem operation, then cancel mode before attempting any other operation. (To cancel, dial: 2 * 0 # 0 0)

(b) ***TEC-20 Set-up:***

(1) Two TEC-20s are required
(2) Both TEC-20s must be programmed identically
(3) Connect TEC-20s to each other by the RS232 jacks using a WICA500017 cable.
(4) For audio connection between TEC-20s:

- COIN PHONE
  - Connect TEC-20s together at J1 jack using cable WICA500016.
  - Connect phone to jack J2.
- STANDARD PHONE
  - Connect TEC-20s together at J2 jack using cable WICA500016.
  - Connect phone to jack J3.

CAUTION: Do <u>not</u> connect battery feed of two TEC-20 units together. Use only cables or WICA500016 for the audio connection.

- One TEC-20 will be the calling unit (A) and the second TEC-20 will be the answering unit (B).
- Dial a seven-digit number into unit "A". The first digit should be a "9" and the seventh digit should be the unit code you are calling.

Example:

9XX-XXXZ (Z=0=9) or dial 1-800-XXX-XXXZ, where the eleventh digit will be the unit code you are calling.

- Unit "B" should ring if it's on hook. Unit "A" should generate ring-back.
- If unit "B" is off hook, unit "A" generates slow busy.
- If unit code is not found, unit "A" generates fast busy.
- (Coin Phone) If base rate is not met, unit "A" generates fast busy.
- Unit "B" controls the trunk. Unit "A" cannot

return dial tone until unit "B" hangs up.

- (Coin Phone) Monies are collected if call is completed, and refunded in all other cases.

- When unit "B" comes off-hook after being called, an audio connection is made between the units by cable WICA500016.

CONTENTS PAGE

7. COMPUTER EXTERNAL CONTROL

7.01 *General* ..... 7 - 1

7.02 *Remote Control Set Up* ..... 7 - 1

7.03 *Off Hook Verification* ..... 7 - 1

7.04 *DTMF Tone Detection* ..... 7 - 1

7.05 *Ringer Test Output* ..... 7 - 2

7.06 *Dial Pulse Digit Collect* ..... 7 - 2

7.07 *Coin Present Detection* ..... 7 - 2

7.08 *Coin Collect/Refund Signal Generation* ..... 7 - 2

7.09 *Loop Current Control* ..... 7 - 2

7.10 *Generate Tone Sequence* ..... 7 - 2

7.11 *DTMF Data Transmission* ..... 7 - 3

7.12 *MF Data Transmission* ..... 7 - 3

7.13 *300 Baud Modem Output Test Stream* ..... 7 - 3

7.14 *300 Baud Modem Receive Test* ..... 7 - 4

7.15 *DTMF Digit Collect and Report* ..... 7 - 4

7.16 *Amplitude Read* ..... 7 - 4

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7. COMPUTER EXTERNAL CONTROL

7.01 ***General:*** A PC/TEC-20 communications test link may be established with the following criteria:

- 1200 baud, 1 start bit, 8 data bits, 2 stop bits, and no parity standard ASCII character set
- Line field will start with "S"
- The next characters will identify type of data "ID"
- Up to 16 ASCII digits may be sent following field start
- End of line sentinel will be a (CR) carriage return. This will occur any time immediately following the ID character. The (CR) character can occur after any data digit which signifies end of field; if 16 data characters are sent (the maximum allowed) the (CR) character must follow the 16th data digit. Transmission is half duplex.

7.02 ***Remote Control Set Up:*** The TEC-20 must be powered up in the battery feed mode with dial/ring switch in the up, or dial/ring, position. The display on the TEC-20 will read "on hook/batt. feed". The PC must send a @(CR) command to RS232 input of TEC-20 to activate remote control set up. The PC sends SB0(CR) to deactivate remote control function or remove power from TEC-20.

7.03 ***Off Hook Verification:*** The test computer will send a command SB1(CR) to the TEC-20 which will cause the TEC-20 to examine the line under test and determine if it is an off-hook or on-hook condition. After this test is complete the TEC-20 will send a message (SB1A(CR) - off-hook; SB1B(CR) = on hook) back to the test computer, indicating the results of this test.

7.04 ***DTMF Tone Detection:*** The test computer will send a command SB2(CR) to the TEC-20 which will cause the TEC-20 to examine the line under test and wait for a DTMF digit to appear on the line under test. The TEC-20 will exit the test after 10 seconds if no tone is detected. If tone is detected, the TEC-20 will send back the frequency of the pulse to the test computer at the best precision of the TEC-20 measurement. TEC-20 response commands; SB2(CR) = No digit received (timeout).

SB2XYYYZZZZ(CR) = Digit

Where X = 0 thru 9 for digit 0 thru 9
= A for A
= B for B
= C for C
= D for D
= E for *
= F for #

Where YYY measured Freq. (low) of digit received (Hz)

Where ZZZZ measured Freq. (high) of digit received (Hz)

7.05 ***Ringer Test Output:*** The test computer will send a command SB3ZXY(CR) to the TEC-20 which will cause the TEC-20 to place a ring voltage at a specified frequency with a specified cadence onto the line under test. The data fields sent from the test computer will specify the frequency of ringing (Z), the on time (X) and off time (Y) of this signal (see Table D). The TEC-20 will continue to supply this signal until a SB4(CR) command is sent from the test computer telling the TEC-20 to remove the ring signal or the TEC-20 detects ring trip (off-hook); TEC-20 would respond with SB1A(CR). If ring trip does not occur at the end of one minute, the TEC-20 will terminate the ring signal and send the command SB2(CR) to the computer.

7.06 ***Dial Pulse Digit Collect:*** The test computer will send a command SB5(CR) to the TEC-20 which will cause the TEC-20 to look for a Dial Pulse Digit on the line under test. When the TEC-30 has collected the digit, it will send the results back to the test computer. The data field associated with this message will contain the value of the digit collected, the speed and the make/break ratio of this digit.

This command may be terminated before a digit is collected by a 10 second timeout or an abort command from the test computer.

TEC-20 command sequence:

PC sends SB5(CR) – TEC-20 response = SB5XYYZZ(CR)
Where X is the value of the digit
YY is the speed of digit (PPS)
ZZ is the make break ration (%)

- or -

TEC-20 response = SB2(CR) if no digit received in 10 seconds PC sends SB4(CR) or next command to abort sequence.

7.07 ***Coin Present Detection:*** The test computer will send a command SB7(CR) to the TEC-20 which will cause the TEC-20 to examine the line under test for a coin present signal (tip ground). After the TEC-20 has tested the line, it will return the result of the test to the test computer. The result being "ground detected" on the tip lead or "ground not detected" on the tip lead of the line under test.

Command sequence – PC sends SB7(CR)
TEC-20 response – SB5(CR) coin detected
SB6(CR) coin not detected

7.08 ***Coin Collect/Refund Signal Generation:*** The test computer will send a command to the TEC-20 which will cause the TEC-20 to place coin collect or refund signals on the line under test.

Command sequence – PC sends SB8(CR) to initiate a refund cycle
- PC sends SB9(CR) to initiate a collect cycle
- TEC-20 response – SB8XXX(CR)

Where XXX is operate time of the relay in milliseconds.
TEC-20 sends – SB7(CR) if no coin is present
– SB9(CR) coin stuck

7.09 ***Loop Current Control:*** The test computer will send a command to the TEC-20 which will cause the TEC-20 to supply normal loop current, reverse loop current, or no loop current. The data field associated with this command will determine which of the three conditions will be placed on the line under test. The TEC-20 will continue the loop current state specified by the last loop current control command or until some other test or command forces a change on the current loop current state. When hang-up occurs, the line will return to normal if it was in a reversed state.

Command sequence – PC sends
SB6A(CR) = Normal battery feed
SB6B(CR) = Reverse battery feed
SB6C(CR) = No battery feed

7.10 ***Generate Tone Sequence:*** The test computer will send a command to the TEC-20 which will cause the TEC-20 to supply the tone as specified in the command.

Command Sequence

PC sends SD001(CR)	* Slow busy (480/620 Hz) 60 IPM
SD002(CR)	* Fast busy (480/620 Hz) 120 IMP
SD003(CR)	* Ring-back steady (440/480 Hz) 2 sec on/4 sec off

SD004(CR)	Ring-back (440/480 Hz) + 380 Hz. Two bursts of ring-back followed by 380 Hz for two seconds.
SD005(CR)	Ring-back (440/480 Hz) Two bursts of ring-back followed by 400 Hz for two seconds
SD006(CR)	* 1000 Hz steady
SD006(CR)	* 1000 Hz steady
SD007(CR)	MF collect (700/1100 Hz)
SD008(CR)	MF refund (1100/1700 Hz)
SD009(CR)	MF ring-back (700/1700 Hz)
SD010(CR)	ACTS/ABC tone
SD011(CR)	* Dial tone
SD012(CR)	* Modem answer
SD013(CR)	Nickel sequence 1700/2200 one burst
SD014(CR)	Dime sequence 1700/2200 two bursts
SD015(CR)	Quarter sequence 1700/2200 5 bursts
SD016(CR)	* 2600 Hz tone
SD017(CR)	380 Hz answer tone for two seconds
SD018(CR)	400 Hz answer tone for two seconds
SD019(CR)	Redirect tone (400 Hz on and off for 100 ms)
SD023(CR)	Reorder SIT
SD024(CR)	Vacant SIT
SD025(CR)	No connect SIT
SD026(CR)	Intercept SIT
SD027(CR)	Reorder SIT interconnect
SD028(CR)	No connect SIT interconnect

* Tones will be continuous until abort command is received. No further digits will be processed.

7.11 ***DTMF Data Transmission:*** The TEC-20 will generate DTMF digits under control of the remote PC.

Command sequence – PC sends SCOXYZZZZZZZZZZ(CR)

Where X is the on time of digit and Y is the interdigital time of the digit, Z is the value of the digit. See Table A (page 7-4) for X and y values.

TEC-20 responds with SB4(CR) after transmission.

7.12 ***MF Data Transmission:*** The TEC-20 will generate DTMF digits under control of the remote PC.

Command sequence – PC sends SCIXYZZZZZZZZZZ(CR)

Where X is the on time of the digit and Y is the interdigital time for the digit. See Table A (page 7-4) for the time values of X and y. Z is the value of the MF digit. See Table B (page 7-4) for values.

7.13 ***300 Baud Modem Output Test Stream:*** The test computer will send a command to the TEC-20 which will cause the TEC-20 to be either the called or calling modem and send a string of characters over the line under test.

TEC-20 Modem command sequence:
TEC-20 (answer modem) terminal: PC sends — SC2YYYYYYYYYYYYYY(CR)
Carrier = 2225 Hz

TEC-20 (originate modem) terminal: PC sends — SC3YYYYYYYYYYYYYY(CR)

Carrier = 1270 Hz

After execution of the data stream, the TEC-20 will send SB4(CR) to indicate that all characters have been sent.

7.14 ***300 Baud Modem Receive Test:*** The test computer will send a command to the TEC-20 which will cause the TEC-20 to be either the called or the calling modem and receive a string of characters over the line under test.

TEC-20 Modem command sequence
TEC-20 (Answer receive modem) terminal — PC sends SC6(CR)
TEC-20 (Originate receive modem) terminal — PC sends SC7(CR)

Timeout will occur if carrier is not received in 10 seconds. TEC-20 will send characters received to the PC up to a maximum of 32 characters.

7.15 ***DTMF Digit Collect and Report:*** The test computer will send a command to the TEC-20 which will cause the TEC-20 to transmit ASCII value of all DTMF digits from the line under test to the test computer. The TEC-20 will send digits as soon as they are received and will continue to do so until the test computer sends a message to the TEC-20 terminating this operation.

Command sequence – PC sends SC4(CR)

TEC-20 sends X(CR), where X is the ASCII character received of the DP or DTMF digit.

7.16 ***Amplitude Read:*** The TEC-20 will take a reading of the audio power from the line under command of the PC.

Command sequence – PC sends SC5(CR)

TEC-20 responds with XX(CR), where XX is the dB reading in hexidecimal. See Table C for hex. to dB conversion.

Note: Command structure is single threaded. All commands sent during a command in progress will be ignored with the exception of the abort command. The abort command will terminate the test that is currently executing.

TABLE A

Digit Value for X & Y	Time in Ms.	Digit for X & Y	Time in Ms.
1	35	7	65
2	40	8	70
3	45	9	75
4	50	0	80
5	55	*	100
6	60	#	200

TABLE B

Z	MF Digit	Frequencies
1	1	700 + 900 Hz
2	2	700 + 1100 Hz
3	3	900 + 1100 Hz
4	4	700 + 1300 Hz
5	5	900 + 1300 Hz
6	6	1100 + 1300 Hz
7	7	700 + 1500 Hz
8	8	900 + 1500 Hz
9	9	1100 + 1500 Hz
B	KP	1100 + 1700 Hz
A	O	1300 + 1500 Hz
C	ST	1500 + 1700 Hz

TABLE C

Hexidecimal	dB	Hexidecimal	dB
FE	+4	2D	-12
FA	+3	2B	-13
E1	+2	24	-14
C7	+1	1F	-15
B2	0	1C	-16
AB	-1	19	-17
8E	-2	17	-18
7E	-3	14	-19
71	-4	12	-20
64	-5	10	-21
59	-6	0E	-22
51	-7	0C	-23
47	-8	0B	-24
3F	-9	0A	-25
39	-10	09	-26
32	-11		

TABLE D

Z	Frequency	X or Y	Time
1	30 Hz	1	1 Sec
2	42 Hz	2	2 Sec
3	54 Hz	3	3 Sec
4	66 Hz	4	4 Sec
5	16 Hz	5	5 Sec
6	20 Hz	6	6 Sec

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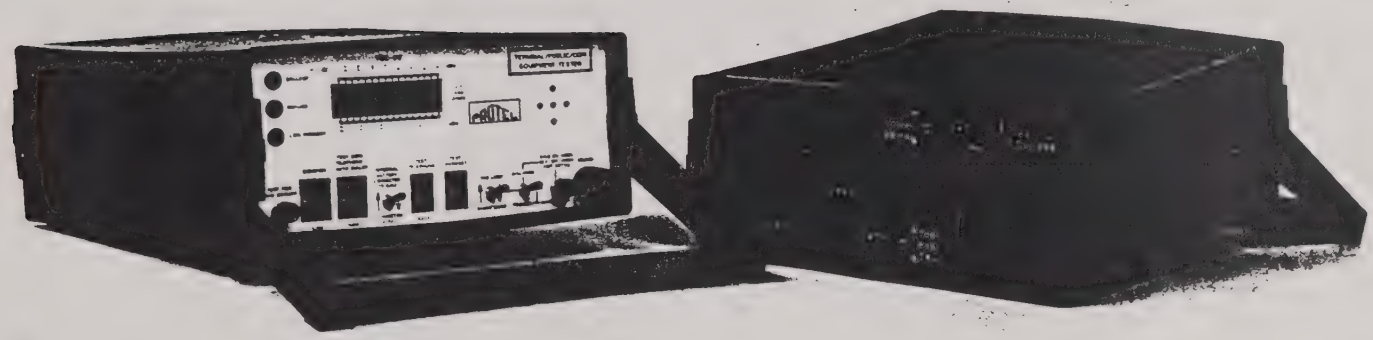

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The TEC-20 . . . It'll test everything but your patience.

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Specifications

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Operational Tests

Public Telephones
- DP dial — character, speed, % break
- DTMF dial — character, frequencies, amplitude, twist, polarity guard
- Ringer — frequency
- Coin relay operate current and timing
- Coin deposit signals
- Totalizer base rate setting
- Operator attach/detach simulation
- Open loop coin check
- Credit card reader digit output

Select-A-Carrier and Store and Forward/Repertoire Dialers
- DTMF sending — character, frequencies, amplitude, twist
- DP sending — character, speed, % break
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- Multiple dial and progress tones, including 380, 400, 440, 480, # and precise dial tone
- Programmable for "Not on Network" (NON) switch response
- Incoming calls
- Programming of dialers is possible without tying up a Central Office line.

Functional Specifications

Central Office Simulator
Battery feed: ~~44V~~ 47V ± 1%
Short loop: 440 ohms
Long loop: 1380 ohms
} ±5%
Long. Bal.: Exceeds FCC Part 68 requirements
Term impedance: 600 ohms ± 1%
Dial tone: 350/440 Hz adjustable amplitude
Ringing generator: (Selectable)
16⅓, 20, 30, 42, 54, 66⅔ Hz
75V RMS (over current protected)
Termination: USOC RJ11, RJ31 & RJ32
Coin collect/refund
User programmed for various response tones such as ring back, busy, S.I.T., etc.
Simulate prepay coin repeater
Programmable DTMF, MF or FSK digit sending

Dial Pulse Analyzer
Range, speed: 7-~~22~~ 14 pps ± 5%
Range, M/B ratio: 30 to 75% ± ~~1%~~ 5%
Display: Speed, % break

DTMF Receiver/Frequency Meter
Measurement time: 40 ms (both frequencies)
Dynamic range: −22 dBm to +4 dBm per Freq.
Frequency range: ± 2.2% of DTMF standards
Display: 32 digits
Display-on-command: Standard frequencies vs. actual frequencies of last digit dialed

Power Meter (Dual Range, True RMS)
Range A: −26 dBm to +4 dBm ± dB (Ref. to 600 ohms)
Range B: −22 dBm to −7 dBm ± .5 dB (Ref. to 600 ohms)
Display: 16 segment bar graph

Digital Display
32 digit, dot matrix, LCD

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- High impedance MONITOR Mode bridge to monitor signal power and DTMF digits on existing loops
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- CC001 Attache Carrying Case
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